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Hands-on Plasticine Illustration of Cross-Sectional Anatomy of Abdomen CT Scan Improves Medical Student Skills and Confidence Levels

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Abstract

Radiology is an extremely important element of medicine to which medical students are often difficult to master. We incorporated a hands-on plasticine illustration course of cross-sectional anatomy of abdomen CT scan to help students understanding cross-sectional anatomy. By hands-on plasticine making of cross-sectional anatomy of abdomen CT scan images, students learned how cross-sectional two-dimensional images were created from three-dimensional structure of human organs. Most students in the hands-on plasticine illustration course group responded positively to this approach, and their average score on CT examination was higher than that of the group that did not take part in the course. Hands-on plasticine illustration appears to be a useful supplement to radiologic anatomy education. It would enhance the radiological interpretive skills, and improve the confidence, in medical students.

Keywords: Cross-sectional Anatomy, Radiology, CT Scan Education, Medical Student

1. Introduction

Radiography, especially CT images, requires thorough knowledge of cross-sectional anatomy, which plays a vital role in patient diagnosis and treatment. However, it is difficult for medical students to understand the conversion of the three-dimensional structure of the human body to the two-dimensional CT cross-sectional images (Baschera et al.,2015), which is also a difficult point in clinical imaging education (Ganske et al.,2006). We incorporate hands-on plasticine modeling (Anna et al.,2013) into the course of abdominal CT anatomy to help students learn cross-sectional anatomy.

2. Materials and Methods

We randomly selected 40 students from the third-year students of the First Affiliated Hospital of Xi'an Jiao tong University School of Medicine and the third-year students of the Second Affiliated Hospital to participate in this research. After random lottery, the students of the First Affiliated Hospital were included in the research group. Participate in a four-week course of making models of cross-sectional anatomy by hand. Students are required to use plasticine to make corresponding models based on CT images of the abdominal cross-section. Students compare the anatomical atlas and abdominal CT images and use different colors of plasticine to create abdominal organs that are consistent with CT images, such as stomach, duodenum, pancreas, spleen, liver and gallbladder. When students make a model, they must first determine the color and structure order of each part or part of the organ. Secondly, by referring to the pictures and figures in the textbooks and atlases, according to the personal knowledge of the organ structure, they used colored plasticine to make the organs in sections (Figures 1). Third, cool and fix the finished plasticine model at room temperature. The students in the experimental group participated in the production of 10 abdominal CT cross-sections at different levels of the upper abdomen, and continued to make learning time for four weeks. On average, each student produced about 40 models, and the 40 students in the control group only used textbooks and atlases for learning. Fourth After the training course, the teacher will perform the anatomical identification of upper abdominal

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CT tissues and organs and the identification of abnormal CT images for the two groups of students, such as the location of stomach tumors, the relationship with surrounding organs, the condition of lymph nodes, the relationship between tumor and blood vessels. There was no significant difference between the experimental group and the control group in the previous imaging diagnostic level test.

We conducted a feedback survey on the intervention group on the last day of the fourth week of the hand-made course to investigate students' satisfaction with this modeling method of learning cross-sectional anatomy. To study the effectiveness of this method for cross-sectional anatomy learning, we used clinically confirmed CT of the upper abdomen of real patients (two cases of gastric cancer, two cases of pancreatic cancer, two cases of gallbladder stones, two cases of liver cancer, two cases of cholangiocarcinoma) designed a test paper team composed of 40 questions for two groups of students to assess, and the test results of two groups were analyzed statistically by t-test.

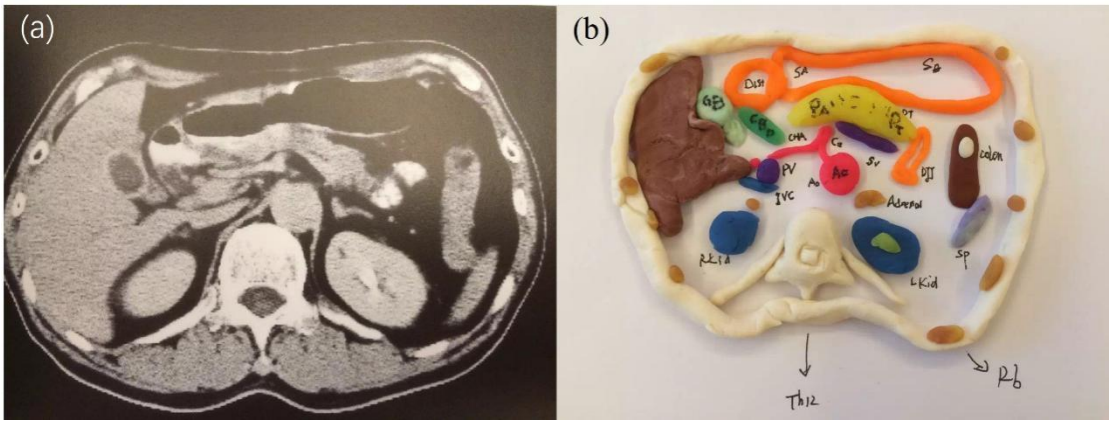

Figure 1. (a) A atlas of CT anatomy of the abdomen used in this study; (b) Hands-on plasticine illustration of the Figure 1 (a).

3. Results

At baseline, self-confidence scores (Herron et al.,2019);(Park,2018) were similar between the two groups (Figure 3).

Students were also asked to rate their confidence with regard to ability to complete the tasks in Table1 on a scale of 1 (not at all confident) to 5 (extremely confident). The mean confidence ratings pre-and post- intervention are given in Table1. Confidence levels for all tasks increased post-intervention significantly.

Table 1. Confidence ratings pre- and post-intervention (n= 40 students)

	Pre-intervention meanconfidence rating (SD)	Post intervention meanconfidence rating (SD)	p-value
Determining if the CT is normal or abnormal	1.8 (0.90)	4.5 (1.00)	<0.001
Determine the location of the tumor	1.8 (0.92)	4.3 (0.90)	<0.001
Determine the relationship between the tumor and surrounding blood vessels	1.7 (0.93)	4.2 (0.90)	<0.001
Determine the condition of the lymph nodes around the tumor	2.1 (0.99)	4.7 (1.03)	<0.001
Determine the resectability of the tumor	1.5 (0.64)	4.1 (0.61)	<0.001

Before the course, there was no difference in CT imaging diagnostic scores (Qingwu et al.,2014) between the intervention group and the control group.

There was a significant difference between the two groups after the four-week course. The average score of the intervention group was 36/40 (90%), which was significantly hiher than the control Group (21/40 or 52.5%). (Figure 2).

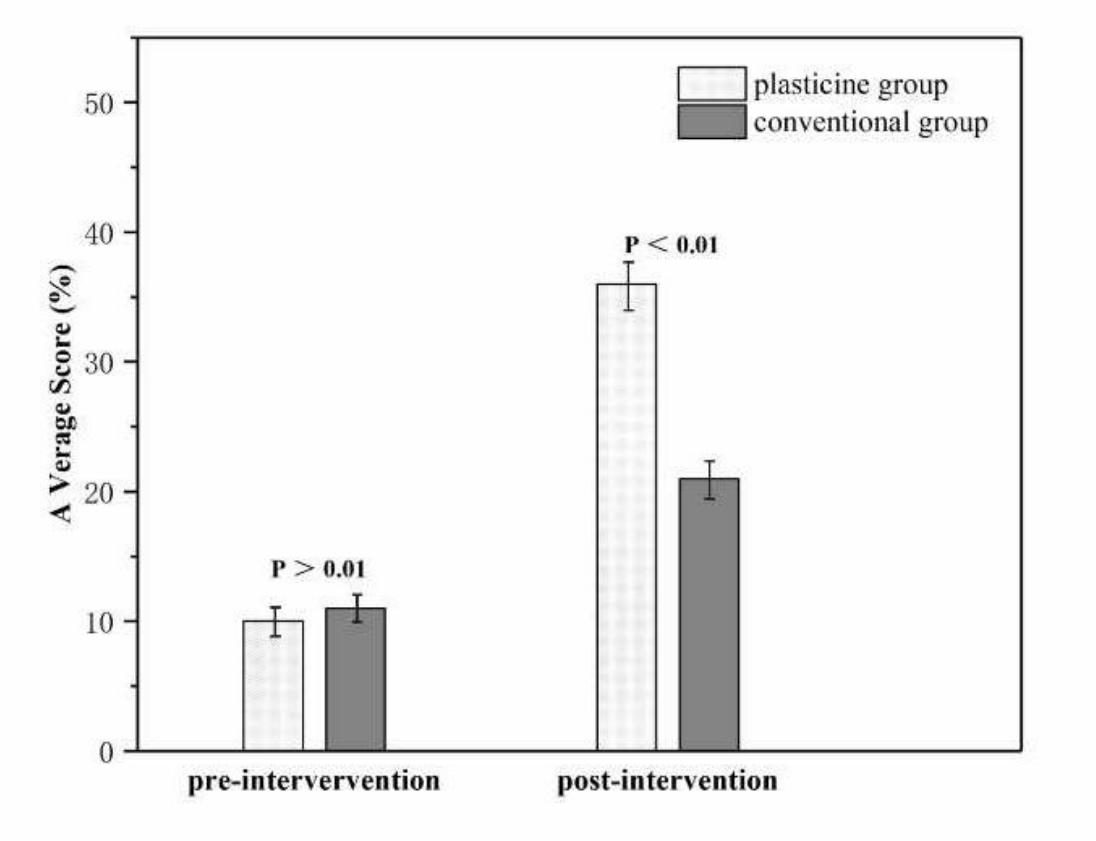

Figure 2. Difference in score between intervention and non intervention groups

4. Discussion

Previous studies have found that the use of radiology images in anatomy courses can increase students' interest in general anatomy (Jang et al.,2018; Torres et al.,2016) and have shown that the use of clay models is effective in learning human body structure (Oh et al.,2009). CT imaging is the most common diagnostic method in clinical practice. Medical imaging courses have been offered to the third-year students of medical colleges in most of the world (Marom & Tarrasch,2015; Yan-Ru & Li-Xia,2018). However, for undergraduate medical students who are usually just familiar with the three-dimensional human structure, they will encounter many difficulties in understanding when directly converting three-dimensional to the two-dimensional cross-sectional structure (Casciato et al.,2018). It is the key and difficulty of clinical teaching, and it is also a bottleneck restricting medical students to increase the level of quality assessment and diagnosis and improving healthcare delivery (Perumal,2018; Simon et al.,2019). Therefore, we designed this study to let students use colored plasticine to construct models according to the CT cross-sectional anatomical atlas by themselves. From the feedback survey of the students, they seem to have a better and easier understanding of the three-dimensional relationship between the structure and its cross-sectional images (Kennedy & Nelson, 2007). The vast majority of students responded positively to their learning satisfaction by making models. Students reported that this learning method has improved their confidence in disease diagnosis. At the same time, students who received training interventions showed that their diagnostic capabilities havea significant improvement.

5. Conclusion

The positive feedback received from students, the improvement in diagnostic skills and the increased confidence levels demonstrated by students suggest that hands-on plasticine illustration of cross-sectional anatomy of abdomen CT scan could be greatly beneficial and a useful addition to undergraduate medical school curricula.

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